SECTION 02813 - LAWN SPRINKLER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes piping, valves, sprinklers lawn sprinkler specialties, controls, and wiring.
   1. Install Complete new sprinkler system.
   2. Demo for abandon underground piping. Remove all existing above ground sprinklers. Move irrigation manhole and irrigation service as shown on drawings.

1.3 DEFINITIONS

A. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.

B. Drain Piping: Downstream from circuit-piping drain valves. Piping is not under pressure.

C. Pressure Piping: Downstream from point of connection to water distribution piping to and including control valves. Piping is under water distribution system pressure.

D. The following are industry abbreviations for plastic materials:
   1. ABS: Acrylonitrile-butadiene-styrene plastic.
   2. NP: Nylon plastic.

3. PE: Polyethylene Plastic.
4. PP: Polypropylene plastic.
5. PTFE: Polytetrafluoroethylene plastic.
6. PVC: Polyvinyl chloride plastic.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Minimum Water Coverage: 100 percent of turf and planting areas.

B. Location of Sprinklers and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards.

C. Contractor shall install sprinklers in patio area to match plant placement and plant type.

D. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties, unless otherwise indicated:
1. Pressure Piping: 200 psig (1380 kPa).
2. Circuit Piping: 150 psig (1035 kPa).
3. Drain Piping: 100 psig (690 kPa).

1.5 SUBMITTALS

A. Product Data: Include pressure rating, rated capacity, settings, and electrical data of selected models for the following:
1. Water regulators.

2. Water hammer arresters.
3. Valves. Include aboveground and underground; general-duty, manual and automatic control, and quick-coupler types.
4. Valve boxes.
5. Sprinklers.
6. Specialties. Include emitters, drip tubes, and other devices.
7. Controllers include wiring diagrams.

B. Shop Drawings: Show lawn sprinkler piping, including plan layout and locations, types, sizes, capacities, and flow characteristics of lawn sprinkler piping components. Include water meters, backflow preventers, valves, piping, sprinklers and devices, accessories, controls, and wiring. Show areas of sprinkler spray and overspray.

C. Coordination Drawings: Show piping and major system components. Indicate interface and spatial relationship between piping, system components, adjacent utilities, and proximate structures.

D. Test Reports: As specified in "Field Quality Control" Article in Part 3.

E. Maintenance Data: To include in maintenance manuals specified in Division 1. Include data for the following::

1. Water regulators.
2. Automatic control valves.
3. Sprinklers.
4. Specialties.
5. Controllers

1.6 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of lawn sprinkler piping components and are based on

specific types and models indicated. Other manufacturers' products with equal performance characteristics may be considered.

B. Electrical Components, Devices, and accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

C. Comply with requirements of utility supplying water and authorities having jurisdiction for preventing backflow and back siphonage.

D. Comply with ASTM F 645, "Guide for Selection, Design, and Installation of Thermoplastic Water Pressure Piping Systems."

E. Comply with NFPA 70, "National Electrical Code", for electrical connections between wiring and electrically operated devices.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves according to the following:
1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves according to the following:
1. Do not remove end protectors unless necessary for inspection; then, reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Deliver piping with factory-applied end caps. Maintain end caps through shopping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

D. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

E. Protect flanges, fittings, and specialties from moisture and dirt.

F. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.8 PROJECT CONDITIONS

A. Research public utility records, and verify existing utility locations.

B. Investigate and determine available water supply pressure and flow characteristics.

C. Site Information: Reports on subsurface condition investigations made during design of Project are available for informational purposes only; data in reports are not intended as warranties of accuracy or continuity of conditions (between soil borings). Owner assumes no responsibility for interpretations or conclusions drawn from this information.

1.9 SEQUENCING AND SCHEDULING

A. Maintain uninterrupted water service to building during normal working hours. Arrange for temporary water shutoff with Owner.

B. Coordinate lawn sprinkler piping with work specified in Division 2 Section "Landscaping."

C. Coordinate lawn sprinkler piping with utility work.

1.10 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to Owner.
   1. Quick Couplers: Furnish quantity of units equal to 10 percent of amount of each size installed.
   2. Sprinklers: Furnish quantity of units equal to 10 percent of amount of each type installed.
   3. Specialties: Furnish quantity of units equal to 10 percent of amount of each type installed.
   4. Valve Keys: Furnish quantity of tee-handle units equal to 10 percent of amount of each type of key-operated, control valve installed.
   5. Quick-Coupler Hose Swivels: Furnish quantity of units equal to 10 percent of amount of each type of quick coupler installed.
   6. Quick-Coupler Operating Keys: Furnish quantity of units equal to 10 percent of amount of each type of quick coupler installed

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Cast-Iron, Gate Valves for Underground Installation:
      a. American Cast Iron Pipe Co.; American Flow Control Div.
      b. Grinnell Corp.; Mueller Co.; Water Products Div.
      c. Stockham Valves & Fittings, Inc.
      d. United states Pipe & Foundry Co.

2. Cast-Iron, Gate Valves for Aboveground and Control-Valve Box Installation:
   a. Grinnel Corp.; Grinnell Supply Sales Co.
   b. Hammond Valve Corp.
   c. Milwaukee Valve Co., Inc.
   d. Nibco, Inc.
   e. Stockham Valves & Fittings, Inc.
3. Bronze Corporation Stops and Valves for Underground Installation:
   a. Grinnell Corp.; Mueller Co.; Water Products Div.
   b. McDonald: A.Y. McDonald Mfg. Co.
   c. Red Hed Manufacturing Co.
4. PVC Valves for Aboveground and Control-Valvue Box Installation:
   a. American Valve, Inc.
   b. Campell Manufacturing Inc.
   c. Colonial Engineering, Inc.
   d. Fischer: George Fischer, Inc.
   e. Nibco, Inc.
   f. Orbit Irrigation Products.
   g. Sloane: R & G Sloane Manufacturing Co., Inc.
5. Plastic, Automatic Control Valves:
   a. Champion Irrigation Products.
   b. Hunter Industries.
   c. Orbit Irrigation Products.
   d. Rain Bird Sprinkler Mfg. Corp.
   e. Toro Co.; Irrigation Div.
6. Control-Valve Boxes:
   a. American Drainage Products, Inc.
   b. AMETEK; Plymouth Products Div.
   c. Applied Engineering Products.
   d. Morrision Molded Fiber Glass Co.; Quazite Div.
   e. NDS, Inc.
   f. Orbit Irrigation Products.
7. Quick Couplers:
   a. Champion Irrigation Products.
   b. Rain Bird Sprinkler Mfg. Corp.

c. Toro Co.; Irrigation Div.
d. Western Brass Works.

8. Sprinklers:
   a. Champion Irrigation Products.
   b. Hunter Industries.
   c. Orbit Irrigation Products.
   d. Rain Bird Sprinkler Mfg. Corp.
   e. Telsco Industries; Weather-Matic Sprinkler Div.
   f. Toro Co.; Irrigation Div.
   g. Western Brass Works.
9. Water Regulators:
   a. Cashco Inc.
   b. Conbraco Industries, Inc.
   c. FLOMATIC Corp.
   d. IMI Cash Valve, Inc.
   e. Watts Industries, Inc.; Water Products Div.
   f. Zurn Industries, Inc.; Wilkins Div.
10. Emitter and Drip-Tube Specialties:
   a. Nibco Irrigation Systems.
   b. Orbit Irrigation Products.
   c. Rain Bird Sprinkler Mfg. Corp.
   d. Toro Co.: Irrigation Div.
11. Miscellaneous Specialties:
   a. Rain Bird Sprinkler Mfg. Corp.
   b. Telsco Industries; Weather-Matic Sprinkler Div.
   c. Toro Co.; Irrigation Div.
12. Controllers:
   a. Champion Irrigation Products.
   b. Orbit Irrigation products.
   c. Orbit Irrigation Products.
   d. Rain Bird Sprinkler Mfg. Corp.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" and "Valve Applications" articles for application of pipe and tube materials, joining methods, and valve applications.

2.3 PIPES AND TUBES

A. PVC Pipe: ASTM D 1785, PVC 1120 compound, Schedules 40 and 80.

B. PVC Pressure-Rated Pipe: ASTM D 2241; PVC 1120 compound; SDR's 21, 26, and 32.5.

2.4 PIPE AND TUBE FITTINGS

A. PVC Socket Fittings, Schedule 40: ASTM D 2466.

B. PVC Socket Fittings, Schedule 80: ASTM D 2467.

C. PVC Threaded Fittings: ASTM D 2464.

D. Transition Fittings: Manufactured assembly or fitting, with pressure rating at least equal to that of system and with ends compatible to piping where fitting is to be installed.

2.5 VALVES AND VALVE SPECIALTIES

A. Cast-Iron Gate Valves: AWWA C500, cast-iron double disc, and seat rings or AWWA C509, resilient seated; bronze stem, cast-iron, or ductile-iron body and bonnet, stem nut, 200-psig (1380-kPa) working pressure; and ends that fit PVC pipe. Include elastomeric gaskets.

B. Bronze Nonrising-Stem Gate Valves: MSS SP-80, Type 1, solid wedge; nonrising, copper-silicon-alloy stem; Class 125, body and screw bonnet of ASTM B 62 cast bronze, with threaded ends. Include PTFE-

impregnated packing, brass packing gland, and malleable-iron handwheel.

C. Bronze Glove Valves: MSS SP-80, Class 125, with fitting for key operation and underground application.

D. Bronze Globe Valves: MSS SP-80, Class 125, with fitting for key operation and underground application.

E. Plastic Diaphragm Valves: Molded-plastic body, normally closed, with manual flow adjustment, and operated by 24-V, ac solenoid.

F. Automatic Drain Valves: Spring-loaded, ball valve of corrosion-resistant construction and designed to open for drainage if line pressure drops below 2-1/2 to 3 psig (17 to 20 kPa).

G. Quick-Couplers: Factory-fabricated, bronze or brass, two-piece assembly. Include coupler water-seal valve; removable upper body with spring-loaded or weighted, rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet; and operating key.
   1. Locking Top Option: Include vandal-resistant, locking feature with two matching keys.

H. Control-Valve Boxes: PE, ABS, fiberglass, polymer concrete, or precast concrete box and cover, with open bottom, openings for piping, and designed for installing flush with grade. Include size as required for valves and service.
   1. Drainage Backfill: Cleaned gravel or crushed stone, graded from 3 inches (75 mm) maximum to 3/4 inch (19 mm) minimum.

2.6 SPRINKLERS

A. Description: Manufacturer's standard sprinklers designed for uniform coverage over entire spray area indicated, at available water pressure.

B. Components: Brass or plastic housing and corrosion-resistant interior parts.

C. Flush, Surface Sprinklers: Fixed pattern, with screw-type flow adjustment.

D. Bubblers: Fixed pattern, with screw-type flow adjustment and stainless-steel retraction spring.

E. Shrubbery Sprinklers: Fixed pattern, with screw-type flow adjustment and stainless-steel retraction spring.

F. Pop-up, Spray Sprinklers: Fixed pattern, with screw-type flow adjustment and stainless-steel retraction spring.

G. Pop-up, Rotary, Impact Sprinklers: Impact drive, full-circle and part-circle types.

H. Aboveground, Rotary, Impact Sprinklers: Impact drive, full-circle and part-circle types.

2.7 SPECIALTIES

A. Water Regulators: ASSE 1003, single-seated, direct-operated, water-pressure regulators, rated for 150-psig- (1035-kpa) minimum, initial-inlet working pressure, with size, flow rate, and inlet and outlet pressures indicated. Include integral factory-installed or separate field-installed Y-pattern strainer that is compatible with unit for size and capacity.
   1. 2-Inch NPS (DN50) and smaller: Bronze body with threaded ends.
   2. 2 1/2 inch NPS (DN65) and Larger: Bronze or cast-iron body with flanged ends.

3. Interior Components: Corrosion-resistant materials.

B. Application Pressure Regulators: brass or plastic housing, 3/4 inch NPS (DN20), with corrosion-resistant internal parts, and capable of controlling outlet pressure to approximately 20 psig (138 kPa).

C. Strainer/Filter Units: Brass or plastic housing, with corrosion-resistant internal parts, of size and capacity required for devices downstream from unit.

D. Single-Outlet Emitters: Plastic body, to deliver the following flow at approximately 20 psig (138 kPa):
1. Flow: 1/2 gph (1.9 L/h).
2. Flow: 1 gph (3/8 L/h).
3. Flow: 2 gph (7.6 L/h).
4. Tubing Size: 10 feet (3 m) long and (1/8 inch (3 mm) minimum ID, PE or vinyl.

E. Multiple-Outlet Emitters: Plastic body with at least six outlets.
1. Flow at 20 psig (138 kPa) Each Outlet: 1/2gph (1.9 L/h).
2. Flow at 20 psig (138 kPa) Each Outlet: 1 gph (3.8 L/h).
3. Flow at 20 psig (138 kPa) Each Outlet: 2 gph (7.6 L/h).
4. Tubing Size: 60 feet (18 m) long and 1/8 inch (3 mm) minimum ID, PE or vinyl.

5. Outlet Caps: Plastic, for outlets without tubing.

F. Drip Tubes: 1/2 inch NPS (DN15) flexible PE or PVC for emitters and other devices of length indicated and with plugged end.

G. Drip Tubes: 3/4 inch NPS (DN20) flexible PE or PVC for emitters and other devices, of length indicated, and with plugged end.

H. Drip Tubes: 1 inch NPS (DN25) flexible PE or PVC for emitters and other devices, of length indicated, and with plugged end.

2.8 AUTOMATIC CONTROL SYSTEM

A. Exterior Control Enclosures: NEMA 250, Type 4 weatherproof enclosure with locking cover and two matching keys; and include provision for grounding.
   1. Material: Molded plastic.
   2. Mounting: Surface type for wall mounting.

B. Interior Control Enclosures: NEMA 250, Type 12 dripproof construction with locking cover and two matching keys.
   1. Material: Molded plastic.
   2. Mounting: Surface type for wall mounting.

C. Transformer: Internal; and suitable for converting 120-V, ac building power to 24-V, ac power.

D. Controller Stations for Automatic Control Valves: Each station is variable from approximately five to 60 minutes. Include switch for manual or automatic operation of each station.

E. Timing Device: Adjustable, 24-hour, 14-day clock with automatic operations to skip operation any day in timer period; to operate every other day; or to operate two or more times daily.
   1. Manual or Semiautomatic Operation: Allow this mode without disturbing preset automatic operation.
   2. Nickel-Cadmium Battery and Trickle Charger: Automatically power timing device during power outages.

F. Wiring: UL 493, Type UF, solid-copper-conductor, insulated cable, suitable for direct burial.
   1. Feeder-Circuit Cables: No. 12 AWG minimum, between building and controllers.
   2. Low-Voltage, Branch-Circuit Cables: No. 14 AWG minimum, between controllers and automatic control valves and color-coded

different than feeder-circuit-cable jacket color and with jackets of different colors for multiple-cable installation in same trench.

3. Splicing Materials: Pressure-sensitive, thermoplastic tape; waterproof sealing packets; or other waterproof connectors.

2.9 IDENTIFICATION

A. Refer to Division 2 Section "Earthwork" for plastic underground warning-tape materials.
   1. Solid blue film with continuously printed black-letter caption, "CAUTION -- WATER LINE BURIED BELOW."
   2. Solid blue film with metallic core and continuously printed black-letter caption, "CAUTION -- WATER LINE BURIED BELOW."

PART 3 - EXECUTION

3.1 PREPARATION

A. Set stakes to identify proposed lawn sprinkler locations. Obtain Utility companies approval before excavation.

3.2 TRENCHING AND BACKFILLING

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

B. Contractor shall coordinate all excavating, trenching with other trades at beginning of project to insure against digging up roads, sidewalks, and utilities.

C. Install warning tape directly above pressure piping, 12 inches (300 mm) below finished grades, except 6 inches (150 mm) below subgrade under pavement and slabs.

D. Install piping and wiring in sleeves under sidewalks, roadways, parking lots, and railroads.
   1. Install piping sleeves by boring or jacking under existing paving if possible.

E. Drain Pockets: Excavate to sizes indicated. Backfill with cleaned gravel or crushed stone, graded from 3 to 3/4 inch (75 to 19 mm) minimum, to 12 inches (300 mm) below grade. Cover gravel or crushed stone with sheet of asphalt-saturated felt and backfill remainder with excavated material.

F. Provide minimum cover over top of underground piping according to the following:
   1. Pressure Piping: Greater depth of minimum of 36 inches (914 mm) below finished grade, or not less than 18 inches (500 mm) below average local frost depth.
   2. Circuit Piping: 12 inches (300 mm).
   3. Drain Piping: 12 inches (300 mm).
   4. Sleeves: 24 inches (600 mm).

3.3 PIPING APPLICATIONS

A. Install components having pressure rating equal to or greater than system operating pressure.

B. Piping in control-valve boxes and aboveground may be joined with flanges instead of joints indicated.

C. Aboveground, Pressure Piping: Use the following:

1. 4 inch NPS (DN100) and Smaller: Schedule 80 PVC pipe, PVC threaded fittings, and threaded joints.

D. Underground, Pressure Piping: Use one of the following:
1. 4 Inch NPS (DN100) and Smaller: Schedule 40 PVC pipe, Schedule 40 PVC socket fittings, and solvent-cemented joints.
2. 4 Inch NPS (DN100) and Smaller: Schedule 80 PVC pipe, Schedule 80 PVC socket fittings, and solvent-cemented joints.
3. 4 Inch NPS (DN100) and Smaller: Schedule 80 PVC pipe, PVC threaded fittings, and threaded joints.

E. Circuit Piping: Use one of the following:
1. 2 Inch NPS (DN50) and Smaller: Schedule 40 PVC pipe socket fittings, and solvent-cemented joints.
2. 2 Inch NPS (DN50) and Smaller: DR 9 PE controlled OD pipe, PE socket or butt-fusion fittings, and heat-fusion joints.
3. 2 Inch NPS (DN50) and Smaller: SIDR 9 PE controlled ID pipe, insert fittings for PE pipe, and banded or coupled joints.

F. Underground branches and Offsets at Sprinklers and Devices: Schedule 80 PVC pipe, PVC threaded fittings, and threaded joints.
1. Option: Plastic piping made for this application may be used instead of pipe and fittings specified.

G. Risers to Aboveground Sprinklers and Specialties: Schedule 80 PVC pipe, Schedule 80 PVC socket fittings, and solvent-cemented joints.

H. Drain Piping: Schedule 40 PVC pipe, Schedule 40 PVC socket fittings, and solvent-cemented joints.

I. Drain Piping: SDR 21, 26, or 32.5 PVC pressure-rated pipe; Schedule 40 PVC socket fittings; and solvent-cemented joints.

J. Sleeves: Schedule 40 PVC pipe, Schedule 40 PVC socket fittings, and solvent-cemented joints.

K. Sleeves: Schedule 80 PVC pipe, Schedule 80 PVC socket fittings, and solvent-cemented joints.

3.4 VALVE APPLICATIONS

A. Aboveground, Shutoff-Duty Valves: Use the following:
1. 2 Inch NPS (DN50) and Smaller: Bronze, nonrising-stem gate valve.
2. 2 Inch NPS (DN50) and Smaller: Bronze, rising-stem gate valve.
3. 2 Inch NPS (DN50) and Smaller: Bronze ball valve.

B. Underground, Manual Control Valves: Bronze globe valve with contorl-valve with control-valve service box and valve key.

C. Control Valves: Use the following:
1. 2 Inch NPS (DN50) and Smaller: Plastic diaphragm valve.

D. Drain Valves: Use the following:
1. 1/2 and 3/4 Inch NPS (DN15 and DN20): Plastic valve.

3.5 JOINT CONSTRUCTION

A. Refer to Division 2 Section "Utility Materials" for pipe joint construction requirements.

B. PVC Piping Gasketed Joints: Construct underground joints between cast-iron valves and PVC pipe with elastomeric seals that fit pipe and valve ends. Use lubricant according to ASTM D 3139.

3.6 PIPING INSTALLATION

A. Locations and Arrangements: Drawings indicate location and arrangement of piping systems, which were used to size pipe and calculate friction loss, and other design considerations. Install piping as indicated, unless deviations are approved on Coordination Drawings.

B. Install Piping at uniform slope of 0.5 percent minimum, down toward drain valves.

C. Install piping free of sags and bends.

D. Install groups of pipes parallel to each other, spaced to permit valve servicing.

E. Install fittings for changes in direction and branch connections.

F. Install unions adjacent to valves and final connections to other components with 2 inch NPS (DN50) or smaller pipe connection.

G. Install underground thermoplastic piping according to ASTM D 2774 and ASTM F 690.

H. Lay piping on solid subbase, uniformly sloped without humps or depressions.

I. Install PVC piping in dry weather when temperature is above 40 deg F (4.4 deg C). Allow joints to cure at least 24 hours at temperature above 40 deg F (4.4 deg C) before testing, unless otherwise recommended by manufacturer.

J. Install water regulators with shutoff valve and strainer on inlet and pressure gage on outlet. Install shutoff valve on outlet.

3.7 VALVE INSTALLATION

A. Underground Gate Valves: Install in valve box with top flush with grade.
1. Install valves and PVC pipe with restrained, gasketed joints.

B. Underground, Manual Control Valves: Install in manual, control-valve service box.

C. Control Valves: Install in control-valve service box.

D. Drain Valves: Install in control-valve box.

3.8 SPRINKLER INSTALLATION

A. Flush circuit piping with full head of water and install sprinklers after hydrostatic test is completed.

B. Install lawn sprinklers at manufacturer's recommended heights.

C. Locate part-circle sprinklers to maintain a minimum distance of 4 inches (100 mm) from walls and 2 inches (50 mm) from other boundaries, unless otherwise indicated.

3.9 AUTOMATIC CONTROL SYSTEM INSTALLATION

A. Install controllers according to manufacturer's written instructions and as indicated.

B. Install control wiring in same trench with piping. Install wiring with loops at control valves and controllers, at intervals not greater than 100 feet (30 m), and changes in direction to allow for expansion. Bundle wiring in same trench at 10-foot (3 m) intervals.

3.10 CONNECTIONS

A. Connect piping to valves, sprinklers, and specialties.

B. Install control wiring in same trench with piping. Install wiring with loops at control valves and controllers, at intervals not greater than 100 feet (30 m), and changes in direction to allow for expansion. Bundle wiring in same trench at 10-foot (3 m) intervals.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

D. Ground electric-powered controllers, valves, and devices.
   1. Tighten electrical connectors and terminals according to manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

E. Arrange for electric-power, wiring, and disconnect switches are specified in Division 16 Sections.

3.11 FIELD QUALITY CONTROL

A. Testing: Hydrostatically test piping and valves before backfilling trenches. Piping may be tested in sections.
   1. Cap and test piping with static water pressure of 50 psig (345 kPa) above system operating pressure and without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours.
   2. Repair leaks and defects with new materials and retest system or portion thereof until satisfactory results are obtained.

3.12 CLEANING AND ADJUSTING

A. Flush dirt and debris from piping before installing sprinklers and other devices.

B. Adjust automatic control valves to provide flow rate of rated operating pressure required for each sprinkler circuit.

C. Carefully adjust lawn sprinklers so they will be flush with, or not more than 1/2 inch (13 mm) above, finish grade.

D. Adjust settings of controllers and automatic control valves.

3.13 COMMISSIONING

A. Starting Procedures: Follow manufacturer's written procedures. If no procedures are prescribed by manufacturers, proceed as follows:
1. Verify that specialty valves and their accessories are installed and operate correctly.
2. Verify that specified tests of piping are complete.
3. Verify that sprinklers and devices are replaced with new materials.
4. Verify that damaged sprinklers and devices are replaced with new materials.
5. Verify that potable-water supply connections have backflow preventers.
6. Energize circuits to electrical equipment and devices.
7. Adjust operating controls.

B. Operational Tests: Adjust each sprinkler to achieve full coverage of landscaped zones.

3.14 DEMONSTRATION

A. Demonstrate to Owner's maintenance personnel operation of equipment, sprinklers, specialties, and accessories. Review maintenance information.

B. Provide seven days' advance written notice of demonstration.

END OF SECTION 02813